

## Chapter 3.2

### Maryland Biological Stream Survey results for the Coastal Bays watershed

Daniel Boward<sup>1</sup> and Ann Schenk<sup>1</sup>

<sup>1</sup>Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment, Annapolis, MD 21401

#### Abstract

Biological community condition showed that streams were degraded. To report overall stream health, freshwater fish and benthic indices of biotic integrity (IBI) were calculated for all sites with adequate data. These IBIs rated stream health according to ecological characteristics of fauna found in that stream. Fish and benthic organisms indicated most streams in the Coastal Bays were degraded. Most fauna found in the stream were classified as pollution-tolerant. Benthic index results from 59 sites rated most sites as either poor (15%) or very poor (75%) with the remaining sites (10%) rated fair. Freshwater fish index results from seven sites rated most sites as very poor (14%) or poor (43%), while 43% rated fair. Impacts to the biota of Coastal Bays streams were likely the result of physical habitat modification (e.g., ditching). Ditched streams generally have less habitat diversity and lower flows than minimally altered streams in the Coastal Plain that retain a more natural wetland character.

#### Introduction

The Maryland Biological Stream Survey (MBSS) monitored freshwater streams throughout the state. Data were collected on physical habitat, water chemistry, and invertebrate and fish communities. A total of 15 fish species (Table 3.2.1) were sampled in Coastal Bays streams, with species counts ranging from seven at two sites in Newport Bay and one site in Isle of Wight Bay, to no fish at one site in Newport Bay and one site in Chincoteague Bay. The average number of species among all Coastal Bays sites was 4.6 and the greatest number of individual fish per site (446) was sampled at a site in Chincoteague Bay. The average number of fish per site among all Coastal Bays sites was 160. The dominant fish species was American eel (*Anguilla rostrata*), averaging 34 fish per site, while the mud sunfish (*Acantharchus pomotis*) was the most rare species (0.1 fish per site on average).

Table 3.2.1: List of fish species collected in the Maryland Coastal Bays during the Maryland Biological Stream Survey. Tolerance to poor water quality and status as native or introduced species is also listed. NC=not classified.

<b>Species</b>	<b>Tolerance</b>	<b>Native or Introduced</b>
American eel, <i>Anguilla rostrata</i>	NC	Native
Banded killifish, <i>Fundulus diaphanus</i>	NC	Native
Bluegill, <i>Lepomis macrochirus</i>	Tolerant	Introduced
Bluespotted sunfish, <i>Enneacanthus obesus</i>	NC	Native
Creek chubsucker, <i>Erimyzon oblongus</i>	NC	Native
Eastern mudminnow, <i>Umbra pygmaea</i>	Tolerant	Native
Golden shiner, <i>Notemigonus crysoleucas</i>	Tolerant	Native
Inland silverside, <i>Menidia beryllina</i>	NC	Native
Largemouth bass, <i>Micropterus salmoides</i>	Tolerant	Introduced
Mosquitofish, <i>Gambusia holbrooki</i>	NC	Native
Pirate perch, <i>Aphredoderus sayanus</i>	Tolerant	Native
Pumpkinseed, <i>Lepomis gibbosus</i>	Tolerant	Native
Redfin pickerel, <i>Esox americanus</i>	Tolerant	Native
Tessellated darter, <i>Etheostoma olmstedii</i>	Tolerant	Native
Mud sunfish, <i>Acantharchus pomotis</i>	Intolerant	Native (State listed as Rare)

Seventy genera of benthic macroinvertebrates were sampled at MBSS sites (Table 3.2.2). The number of genera per site averaged 16.5 and ranged from eight to 27. Dominant taxa included clams (*Sphaerium* sp.), isopods (*Caecitodea* sp., *Crangonyx* sp.), midges (*Cricotopus/Orthocladius*, *Polypedilium* sp.), and black flies (*Simulium* sp.). Stream Waders, a MBSS volunteer program, sampled 66 families of benthic macroinvertebrates, with family richness ranging from four to 20.

Table 3.2.2: List of benthic macroinvertebrate genera collected in the Maryland Coastal Bays during the Maryland Biological Stream Survey. Tolerance to poor water quality is also listed. NC=not classified.

<b>Taxon</b>	<b>Tolerant or sensitive</b>	<b>Taxon</b>	<b>Tolerant or sensitive</b>
<i>Atrichopogon</i>	Tolerant	<i>Microtendipes</i>	Tolerant
<i>Bezzia</i>	Tolerant	<i>Musculium</i>	Tolerant
<i>Caecidotea</i>	Tolerant	<i>Nyctiophylax</i>	Sensitive
<i>Calopteryx</i>	Tolerant	<i>Oecitis</i>	Tolerant
<i>Cheumatopsyche</i>	Tolerant	<i>Orthocladus</i>	Tolerant
<i>Chironomus</i>	Tolerant	<i>Paraleptophlebia</i>	Sensitive
<i>Chrysops</i>	Tolerant	<i>Parametriocnemus</i>	Tolerant
<i>Cnephia</i>	NC	<i>Paratanytarsus</i>	Tolerant
<i>Conchapelopia</i>	Tolerant	<i>Peltodytes</i>	Tolerant
<i>Corynoneura</i>	Tolerant	<i>Phaenopsectra</i>	Tolerant
<i>Crangonyx</i>	Tolerant	<i>Physella</i>	Tolerant
<i>Cricotopus</i>	Tolerant	<i>Pisidium</i>	Tolerant
<i>Cricotopus/Orthocladus</i>	Tolerant	<i>Platycentropus</i>	NC
<i>Cryptotendipes</i>	Tolerant	<i>Polypedilum</i>	Tolerant
<i>Culicoides</i>	Tolerant	<i>Procambarus</i>	Tolerant
<i>Dicrotendipes</i>	Tolerant	<i>Procladius</i>	Tolerant
<i>Diplocladius</i>	Tolerant	<i>Prosimulium</i>	Tolerant
<i>Dubiraphia</i>	Tolerant	<i>Prostoia</i>	Sensitive
<i>Dugesia</i>	Tolerant	<i>Prostoma</i>	Tolerant
<i>Endochironomus</i>	Tolerant	<i>Pseudolimnophila</i>	Tolerant
<i>Gammarus</i>	Sensitive	<i>Ptilostomis</i>	Tolerant
<i>Glytotendipes</i>	Tolerant	<i>Rheocricotopus</i>	Tolerant
<i>Habrophlebia</i>	NC	<i>Simulium</i>	Tolerant
<i>Hemerodromia</i>	NC	<i>Sphaerium</i>	Tolerant
<i>Heterotrissocladius</i>	Tolerant	<i>Stagnicola</i>	Tolerant
<i>Hydrobaenus</i>	Tolerant	<i>Stegopterna</i>	NC
<i>Hydroporus</i>	Tolerant	<i>Stenelmis</i>	Tolerant
<i>Hydropsyche</i>	Tolerant	<i>Symptothastia</i>	Tolerant
<i>Ironoquia</i>	NC	<i>Synurella</i>	NC
<i>Labrudinea</i>	NC	<i>Tanytarsus</i>	Tolerant
<i>Lepidostoma</i>	Sensitive	<i>Thienemanniella</i>	Tolerant
<i>Limnodrilus</i>	Tolerant	Thienemannimyia group	Tolerant
<i>Lype</i>	NC	<i>Tribelos</i>	Tolerant
<i>Menetus</i>	NC	<i>Zavreliomyia</i>	Tolerant
<i>Micropsectra</i>	Tolerant		

### Data sets

Twelve sites were sampled in the Coastal Bays watersheds during 1997 and 2001 as part of the Maryland Biological Stream Survey (MBSS). Fish, benthic macroinvertebrate, and water samples were collected and physical habitat was assessed according to methods described in Kazyak (2001) and Boward and Friedman (2000). Also, spring benthic macroinvertebrate samples were collected (Boward 2000; Boward and Bruckler 2002) at 47 sites as part of DNR's volunteer Stream Waders Program. Table 3.2.3 summarizes MBSS and Stream Waders sampling in Coastal Bays watersheds.

Table 3.2.3: Summary of MBSS and Stream Waders sampling in the Coastal Bays.

Site type	Year	Number of sites	Site selection method	Watersheds sampled
MBSS	1997	3	Non-random	Chincoteague Bay, Isle of Wight Bay, Newport Bay
MBSS	2001	9	Random	Chincoteague Bay, Isle of Wight Bay, Newport Bay
Stream Waders	2001	47	Non-random	Assawoman Bay, Chincoteague Bay, Isle of Wight Bay, Newport Bay, Sinepuxent Bay

### Management Objective: Healthy Stream Fauna

**MBSS Indicator 1:** Fish IBI  $\geq 4$  (thresholds described below)

**MBSS Indicator 2:** Invertebrate IBI  $\geq 4$  (thresholds described below)

### Analyses

To report overall stream health, fish and benthic macroinvertebrate indices of biotic integrity (IBI) were calculated for all sites that had adequate data. The MBSS fish and benthic macroinvertebrate IBIs rate stream health according to ecological characteristics of each assemblage. Table 3.2.4 explains the ranges of the IBI and the corresponding narrative stream health ratings. Reference conditions for the Coastal Bays were defined as those from streams having minimal anthropogenic disturbance, based on thresholds established for water chemistry, physical habitat, and catchment land use. The following 12 criteria were defined (Roth et al. 2000):

- pH  $\geq 6$  or blackwater stream (pH  $< 6$  and DOC  $\geq 8$  mg/L)
- ANC  $\geq 50$   $\mu$ eq/L
- DO  $\geq 4$  ppm
- nitrate  $\leq 300$   $\mu$ eq/L (4.2 mg/L)

- urban land use  $\leq$  20% of catchment area
- forest land use  $\geq$  25% of catchment area
- remoteness rating: optimal or suboptimal
- aesthetics rating: optimal or suboptimal
- instream habitat rating: optimal or suboptimal
- riparian buffer width  $\geq$  15 m
- no channelization
- no point source discharges

Table 3.2.4: Rankings of IBI scores and corresponding comparative measures in relation to reference conditions.

<b>Good</b> (IBI score 4.0 – 5.0)	Comparable to reference streams considered to be minimally impacted.
<b>Fair</b> (IBI score 3.0 – 3.9)	Comparable to reference conditions, but some aspects of biological integrity may not resemble the qualities of minimally impacted streams.
<b>Poor</b> (IBI score 2.0 – 2.9)	Significant deviation from reference conditions, with many aspects of biological integrity not resembling the qualities of minimally impacted streams.
<b>Very Poor</b> (IBI score 1.0 – 1.9)	Strong deviation from reference conditions, with most aspects of biological integrity not resembling the qualities of minimally impacted streams.

Fish IBIs (FIBI) were calculated for seven of the 12 sites in the Coastal Bays watersheds. FIBIs were not calculated for streams with upstream catchment sizes less than 300 acres, dry streams, or blackwater streams. Benthic macroinvertebrate IBIs (BIBI) were calculated for 59 sites (12 MBSS and 47 Stream Waders). A family level BIBI was calculated for spring macroinvertebrate samples collected through the Stream Waders program.

## Results

FIBIs from five sites ranged from 1.8 (very poor) to 3.3 (fair) (Figure 3.2.1). BIBI values ranged from 1.0 (very poor) to 3.6 (fair) (Figure 3.2.2). The percentage of sites in each IBI category is shown in (Figure 3.2.3). Please note that not all streams mentioned in the text and tables are shown on the figure maps.

The following tables list conditions (based on FIBI and BIBI) for MBSS and Stream Waders sites in the Coastal Bays watersheds. Stream Waders sites have numbers only, while MBSS sites contain either a county or watershed code. NA in the BIBI and FIBI

Stream Condition columns indicates no data collected. UT refers to an unnamed tributary of the named waterway.

*Assawoman Bay* – A single Stream Waders sample was taken in the Assawoman Bay watershed (Table 3.2.5). The BIBI for this site was 1.29 (very poor).

Table 3.2.5: 2001 MBSS results for the Assawoman Bay watershed.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0689-3	BACK CREEK	1.29	very poor	NA	NA

*Isle of Wight Bay/St. Martin River* – Twenty-two total sites were sampled in the Isle of Wight Bay Watershed: five by MBSS and 18 by Stream Waders. The three FIBIs range from fair (Crippen Branch off Turville Creek) to poor (South Branch) to very poor (Bishopville Prong upper tributary) (Table 3.2.6). Two sites were rated fair by the BIBI – Bishopville Prong upper tributary and South Branch. All others were rated poor (5%) or very poor (86%).

Table 3.2.6: 2001 MBSS results for the Isle of Wight Bay watershed.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0692-2	CAREY BRANCH	1	very poor	NA	NA
0692-13	PERKINS-BISHOPVILLE UT1*	1	very poor	NA	NA
0691-1	BIRCH BRANCH	1.29	very poor	NA	NA
0692-14	GODFREY AG. DITCH	1.29	very poor	NA	NA
0692-1	CAREY BRANCH	1.29	very poor	NA	NA
0692-6	BISHOPVILLE PRONG UT1 TO UT2	1.29	very poor	NA	NA
0691-7	CHURCH BRANCH	1.57	very poor	NA	NA
0692-7	LAMBARKINS BRANCH	1.57	very poor	NA	NA
0692-8	LAMBKIWS CREEK	1.57	very poor	NA	NA
0692-11	MOSES CREEK	1.57	very poor	NA	NA
0692-12	PERKINS CREEK	1.57	very poor	NA	NA
0692-4	SLAB BRIDGE PRONG	1.57	very poor	NA	NA
0692-9	BISHOPVILLE PRONG UT	1.57	very poor	NA	NA
ISLE-105-R-2001	CRIPPEN BRANCH	1.57	very poor	NA	NA
ISLE-107-R-2001	CRIPPEN BRANCH	1.57	very poor	NA	NA
ISLE-120-R-2001	CRIPPEN BRANCH	1.57	very poor	3.25	fair
0692-10	BISHOPVILLE PRONG UT	1.86	very poor	NA	NA
0690-2	CRIPPEN BRANCH	1.86	very poor	NA	NA
0691-4	MIDDLE BRANCH	1.86	very poor	NA	NA
0692-5	SLAB BRIDGE PRONG	1.86	very poor	NA	NA
0692-3	CAREY BRANCH	2.71	poor	NA	NA
WO-S-022-935-97	BISHOPVILLE PRONG UT	3	fair	1.75	very poor

ISLE-115-R-2001	CHURCH BRANCH	3	fair	2.75	poor
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\* Site is on an unnamed tributary ditch to an unnamed ditch connecting Bishopville Prong and Perkins Creek.

*Sinepuxent Bay* – Stream Waders sampled three sites in the Sinepuxent Bay watershed and all were rated very poor by the BIBI (Table 3.2.7).

Table 3.2.7: 2001 MBSS results for the Sinepuxent Bay watershed.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
0681-2	GRAY'S COVE UT	1.29	very poor	NA	NA
0681-3	GRAY'S CREEK UT	1.29	very poor	NA	NA
0681-1	BAT CREEK	1.57	very poor	NA	NA

*Newport Bay* – Three MBSS (two with FIBIs) and six Stream Waders sites were sampled in the Newport Bay watershed. The two FIBIs reflect fair and poor conditions in Kitts Branch and Bottle Branch, respectively (Table 3.2.8). Two streams (22%) were rated fair by the BIBI. All other streams were rated poor (33%) or very poor (45%) by the BIBI.

Table 3.2.8: 2001 MBSS results for the Newport Bay watershed.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
NEWP-110-R-2001	TUKESBURG BRANCH	1.29	very poor	NA	NA
0683-3	PORTER CREEK	1.57	very poor	NA	NA
0685-1	KITTS BRANCH	1.57	very poor	NA	NA
WO-S-998-936-97	BOTTLE BRANCH	1.86	very poor	2.75	poor
0683-2	POPLARTOWN BRANCH	2.14	poor	NA	NA
0682-2	MARSHALL CREEK	2.43	poor	NA	NA
NEWP-116-R-2001	KITTS BRANCH	2.71	poor	3	fair
0683-1	NEWPORT CREEK	3.00	fair	NA	NA
0682-1	MASSEY BRANCH	3.29	fair	NA	NA

*Chincoteague Bay* - Four MBSS (two with FIBIs) and 20 Stream Waders sites were sampled in the Chincoteague Bay Watershed. FIBIs reflect fair and poor conditions in Payne Ditch (Big Millpond) and Powell Creek, respectively (Table 3.2.9). BIBIs indicate poor conditions in both streams. Two streams (8%; Parodie Branch and Riley Creek) were rated fair by the BIBI. All other streams were rated poor (21%) or very poor (71%) by the BIBI.

Table 3.2.9: 2001 MBSS results for the Chincoteague Bay watershed.

SITE	STREAM NAME	BENTHIC IBI	STREAM CONDITION	FISH IBI	STREAM CONDITION
CHIN-112-R-2001	FIVEMILE BRANCH	1.00	very poor	NA	NA
0671-2	RILEY CREEK	1.00	very poor	NA	NA
0678-5	SCARBORO CREEK	1.00	very poor	NA	NA
0680-3	WATERWORKS CREEK	1.00	very poor	NA	NA
0672-1	MARSHALL DITCH	1.29	very poor	NA	NA
0678-4	SCARBORO CREEK UT	1.29	very poor	NA	NA
0679-1	POORHOUSE BRANCH UT	1.29	very poor	NA	NA
0680-2	WATERWORKS CREEK UT2	1.29	very poor	NA	NA
0675-2	BRIMER GUT	1.57	very poor	NA	NA
0674-3	PIKES CREEK	1.57	very poor	NA	NA
0674-1	PIKES CREEK UT TO UT	1.57	very poor	NA	NA
0674-2	PIKES CREEK UT	1.57	very poor	NA	NA
0680-5	WATERWORKS CREEK UT1	1.57	very poor	NA	NA
CHIN-103-R-2001	WATERWORKS CREEK	1.57	very poor	NA	NA
0671-5	HANCOCK CREEK	1.86	very poor	NA	NA
0679-2	ROBINS CREEK UT TO UT	1.86	very poor	NA	NA
0680-4	WATERWORKS CR UT1	1.86	very poor	NA	NA
0672-2	LITTLE MILL CREEK	2.14	poor	NA	NA
0671-4	POWELL CREEK	2.14	poor	NA	NA
WO-S-999-937-97	PAYNE DITCH	2.14	poor	3.25	fair
0675-1	BRIMER GUT	2.43	poor	NA	NA
CHIN-119-R-2001	POWELL CREEK	2.71	poor	2.25	poor
0672-3	PARADIE BRANCH	3.57	fair	NA	NA
0671-3	RILEY CREEK	3.57	fair	NA	NA

## Summary

Fish and benthic macroinvertebrate data from MBSS and Stream Waders sampling suggest that most streams in the Coastal Bays were degraded. Most taxa from both assemblages were pollution-tolerant. Benthic IBIs from MBSS and Stream Waders samples rated most sites as either poor (15%) or very poor (75%) with the remaining sites (10%) rated fair. Fish IBIs from MBSS samples rated most sites as poor (14%) or very poor (43%), with 43% rated fair.

Impacts to the biota of Coastal Bays streams likely resulted from physical habitat modification (e.g., ditching). Ditched streams generally have less habitat diversity and lower flows than minimally-altered streams in the Coastal Plain that retain their more natural wetland character. For more information on the status of physical and water chemistry, please see the MBSS report (Roth et al. 2003).



## **Acknowledgements**

The MBSS would like to thank all of the Stream Wader and MBSS volunteers who helped collect data in the Coastal Bays.

## **References**

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Figure 3.2.1: Fish Index of Biotic Integrity (FIBI) for freshwater streams of the Coastal Bays watershed sampled in 2001. Streams with watersheds less than 300 acres were not calculated for FIBI.

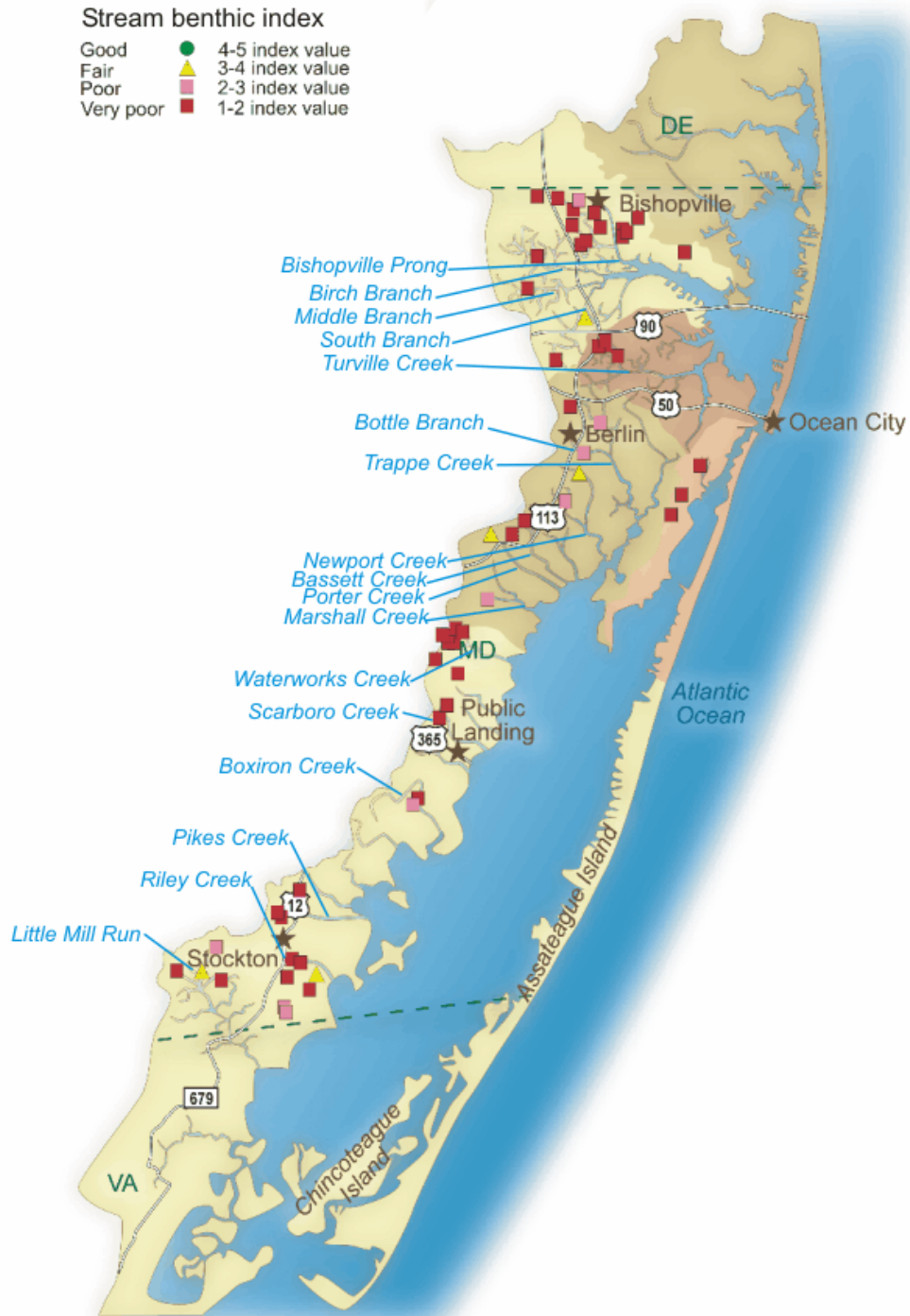
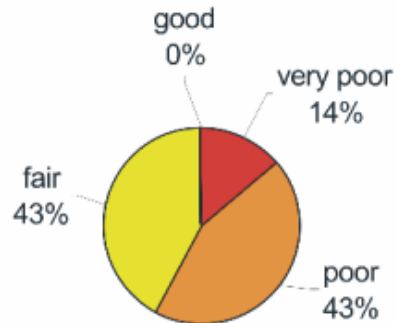


Figure 3.2.2: Benthic Index of Biotic Integrity (BIBI) for freshwater streams of the Coastal Bays watershed sampled in 2001.

A.

**Fish IBI in Coastal Bays Streams (1997, 2001)**  
**Percent of Sites**



B.

**Benthic IBI in Coastal Bays Streams (1997, 2001)**  
**Percent of Sites**

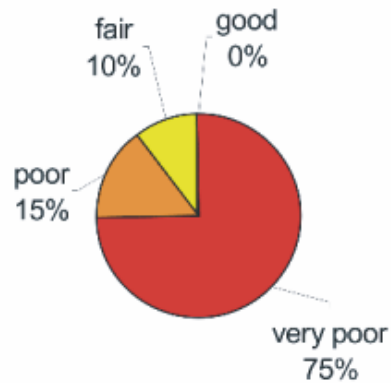


Figure 3.2.3: A.) Percent of sampling sites falling within each of the Fish Index of Biotic Integrity condition categories for 2001 MBSS sampling data. B.) Percent of sampling sites falling within each of the Benthic Index of Biotic Integrity condition categories for 2001 MBSS and Stream Waders sampling data.